Performance of Smoothing by Spectral Dispersion on Beamlet

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ORAL PRESENTATION PREFERRED

Abstract submitted to
2nd Annual International Conference on Solid-State Lasers for
Application to Inertial Confinement Fusion (ICF)
PARIS, France (1996)

The National Ignition Facility (NIF) has been designed such that it will have the capability for both the direct and indirect drive approaches to ICF. In either approach it is necessary to insure that the target is illuminated with a very uniform beam. The beam smoothing method chosen for NIF is smoothing by spectral dispersion (SSD)[1] used in conjunction with a kinform phase plate. The phase plate generates a speckle pattern with a precisely controlled envelope, and the spectral dispersion of bandwidth imposed on the driver beam causes a rapid fluctuation in this speckle pattern. The impact of the high spatial frequencies of the speckle on the target is ameliorated by the averaging of multiple uncorrelated speckle patterns over some effective integration time.

In an ongoing set of experiments, one dimensional SSD has been installed and characterized on Beamlet. Measurements have been performed to verify the spectral, spatial, and temporal characteristics of both the 1ω and the 3ω beams. A key issue is the extent to which the laser performance is degraded from increased near field modulation owing to SSD. This is of particular importance to the NIF, as SSD has not been implemented previously in a multipass amplifier architecture. One expects that near field modulation owing to SSD may result from a number of sources, such as group velocity dispersion, nonuniform spectral gain or loss, clipping in the pinholes, and frequency conversion. In this investigation a front end integrated electrooptic modulator provides bandwidth of up to 100 GHz in the IR and a grating provides the SSD angular divergence of up to 50 μrad (measured in the main laser amplifier cavity). With these parameters, it is expected that an RMS smoothness below ~20% is obtained in the far field. The results of both near field and far field beam characterization, as well as 1ω and 3ω energy performance will be presented.

Reference

1.   S. Skupsky, *et al,* J. Appl. Phys. **66**, 3456 (1989).